UNITED STATES MARINE CORPS

LESSON PLAN

FORCE

INTRODUCTION:

1. Gain Attention. Recall the scene from the movie "Rocky V" where the Russian fighter is training for the match and is seen punching a bag that measures twice the force as Rocky can hit. Is the Russian fighter producing more force because he is bigger or because he is throwing a faster punch?.

2. Overview. This period of instruction introduces and defines the fundamental concepts of force and how it affects objects within the atmosphere.

3. Introduce Learning Objectives.

a. Terminal Learning Objective. Without the aid of references, but in accordance with the instruction, the student shall be able to define the relationships between force, mass and acceleration.

b. Enabling Learning Objective(s). Without the aid of references, but in accordance with the instruction,

(1) Define and provide two examples of the different kinds of forces discussed.

(2) State Newton's first and second laws of motion.

(3) State the variables associated with force and describe their relationships.

4. Method/Media. This period of instruction will be taught using the lecture method with aid of QMMCBT-001 "Introduction to the Dynamics of the Atmosphere".

5. Evaluation. You will be evaluated by demonstrating that you understand effect of forces and the respective variable relationships.

TRANSITION. Every object on Earth experiences "Force" everyday. The next section defines "force" and describes the different types of forces that may be encountered.

BODY:

1. Defining Force. Force is a push or pull upon an object resulting from the object's interaction with another object. Whenever two objects interact, there is a force applied to each object. When this interaction ceases, there is no longer any force applied to either object. Forces only exists as a result of an interaction. There are two types of forces, contact and action-at-a-distance forces.

a. Contact Forces. Contact force is a force in which two objects are physically touching each other. Examples include: frictional forces, tensional forces, air resistant forces, and applied forces.

b. Action-at-a-Distance Forces. An Action-at-a-distance force exists when the two objects are not physically contacting each other, yet are able to exert a push or a pull despite the physical separation. Examples of this type of force are gravitational forces, electric forces, and magnetic forces.

2. Measuring Force.

a. Force is a quantity measured using the fundamental unit called "Newton". One (1) Newton is the amount of force required to give a 1 kg mass an acceleration of 1 m/s^2. A Newton is abbreviated by an "N".

b. Force is a vector quantity, meaning that is has both magnitude and direction. To fully describe a force that is acting upon an object, one needs to describe its magnitude (or size) and the direction. Because force is a vector, it is commonly represented using diagrams where standard vector operations are used to compute total amount of force.

3. Newton's Laws of Motion.

a. First Law of Motion. Newton's first Law of motion states that an object will remain at rest or in a uniform motion in a straight line until acted upon by an external force. Some examples include:

(1) A rock will remain on top of the hill until an external force pushes it downhill.

(2) A rolling ball will continue to roll in a straight line unless an external force causes it to change direction (curve left or right) or stop (friction).

b. Second Law of Motion.

(1) Newton's second law states that the force exerted on an object equals its mass times the acceleration produced. In symbolic form, this law is written as **F=ma.**

(2) From this relationship we can see that, when the mass of an object is constant, the force on the object is directly related to the acceleration that is produced. A force in its simplest form is a push or pull.

(3) Acceleration is the speeding up, the slowing down, or the changing of direction of an object. More accurate, acceleration is the change in velocity over a period of time.

(4) There may be more than one force acting upon an object and Newton's law always refers to the net, or total force that results. An object will always accelerate in the direction of the total force acting on it. Therefore, to determine in

which direction the wind will blow, we must identify and observe all the forces that affect the horizontal movement of air.

OPPORTUNITY FOR QUESTIONS:

1. Questions from the Class. At this time, are there any questions concerning the content you just learned?

2. Questions to the Class.

a. QUESTION. What is Newton's second law of motion?

b. ANSWER. Objects move as fast as they are pushed and how much force is applied.

SUMMARY: The forces that are applied in the earths atmosphere are used dalily to tell the velocity of storms or other severe weather development. They are confusing at first, but once they are understood, they explain so much and reveal so much more.

REFERENCE.

Ahrens, Donald C. Meteorology Today. 4th Edition. West Publishing Company, 1991.